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Cat Pricing Methods
Casualty Actuaries in Reinsurance
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Panelists

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Catastrophe Pricing Methods

This session will provide an overview of the theory and practice of Cat XL treaty pricing, including tools and methodologies

Session outline

- Theory and practice of Cat XL treaty pricing
- Loss costs
  - Credibility
  - Assumptions
- Capital
  - Risk measures
  - Order dependence
- Loss costs
  - Uncertainty
- Q&A

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- Experience
  - As if experience
    - What does it mean to “as if” a property cat loss from 1960 to 2012?
    - How reliable is windspeed data from 1925?
    - How complete is the historical record?
- Exposure
  - Cat models
    - Hazard
    - Vulnerability
    - Financial
- Credibility

Loss cost assumptions

- Hazard
  - Stationary hazard
- Vulnerability
  - Construction material changes
  - Building code changes
- Financial
  - Cat deductibles
  - Loss of profits
  - Valuation
  - Demand surge
- Exposure shifts

Limitations of Cat Models

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- Cat models are collections of event scenarios
  - Discrete approximations, with probabilities attached to each scenario
  - Not exhaustive
  - Limited perils
  - Calibrated using historical experience
    - Recalibrated as required, based on research and actual event experience

Loss cost uncertainty

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Parameter risk

- **Limited sample**
- **e.g., estimating 250-year loss with 100 years of reliable data**

When cat models first came out, loss estimates at various return periods AND upper confidence bounds around those loss estimates were regularly shown as output

Over the course of time, fewer and fewer output summaries have focused on confidence bounds and uncertainty

Loss cost uncertainty

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Suppose we want to estimate “100-year loss” to a portfolio

Suppose we have a reliable sample of 100 years of data

- We might have seen a 100-year loss in the sample (63% of samples, assuming Poisson frequency)
- We might not (37% of samples)

Now suppose we have a reliable sample of 110 years of data

- The above probabilities are revised to 67% and 33%

…and so on…

With a sample of 300 years, the probabilities are 95% and 5%

With a sample of 450 years, the probabilities are 99% and 1%

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Confidence interval statements

Point estimate (e.g., cat model) loss on line = 0.1%

90% confidence interval loss cost: 0% to 1%

Point estimate loss on line = 1%

90% confidence interval loss cost: 0% to 3%

Point estimate loss on line = 5%

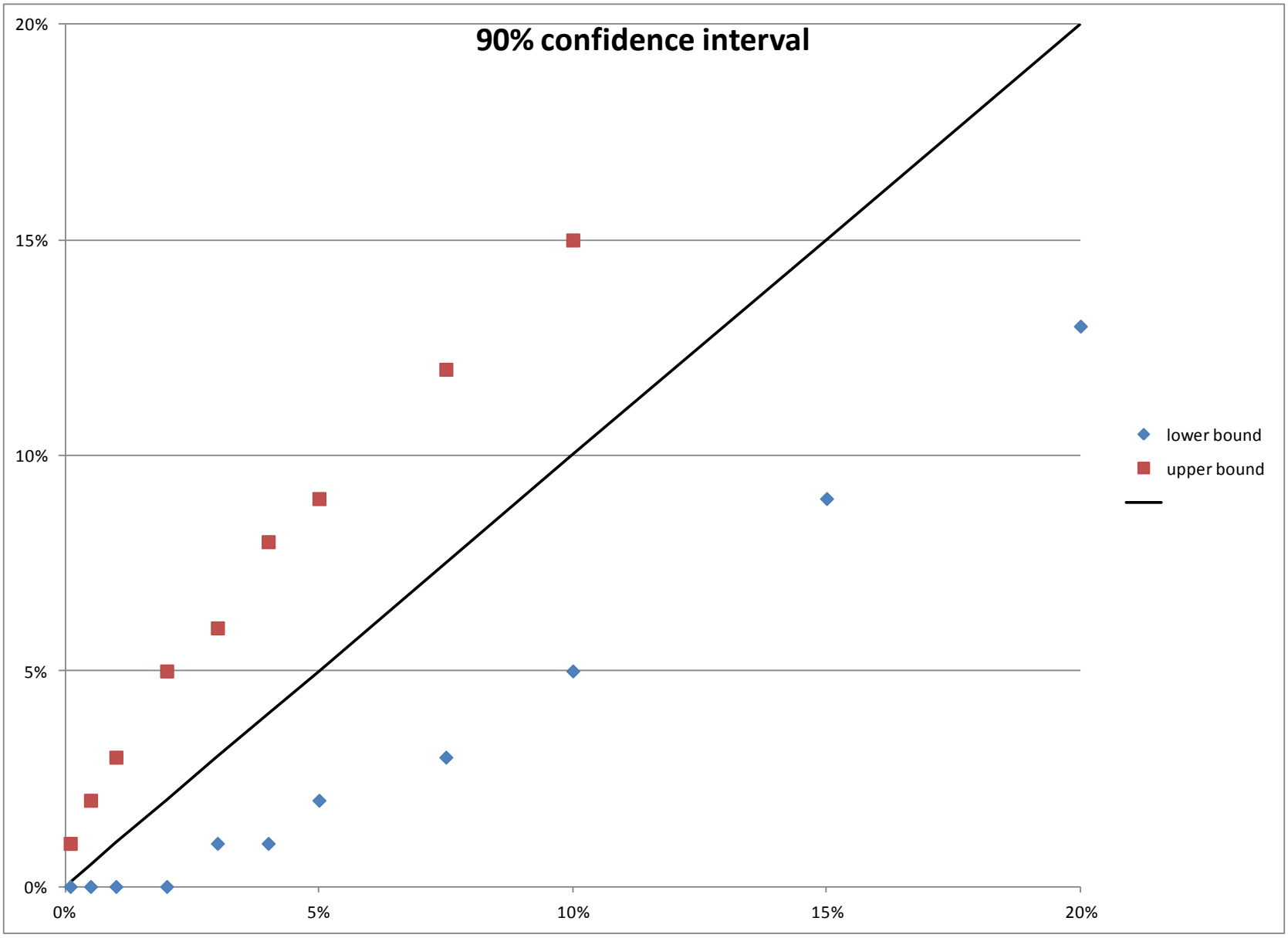
90% confidence interval loss cost: 2% to 9%

Point estimate loss on line = 10%

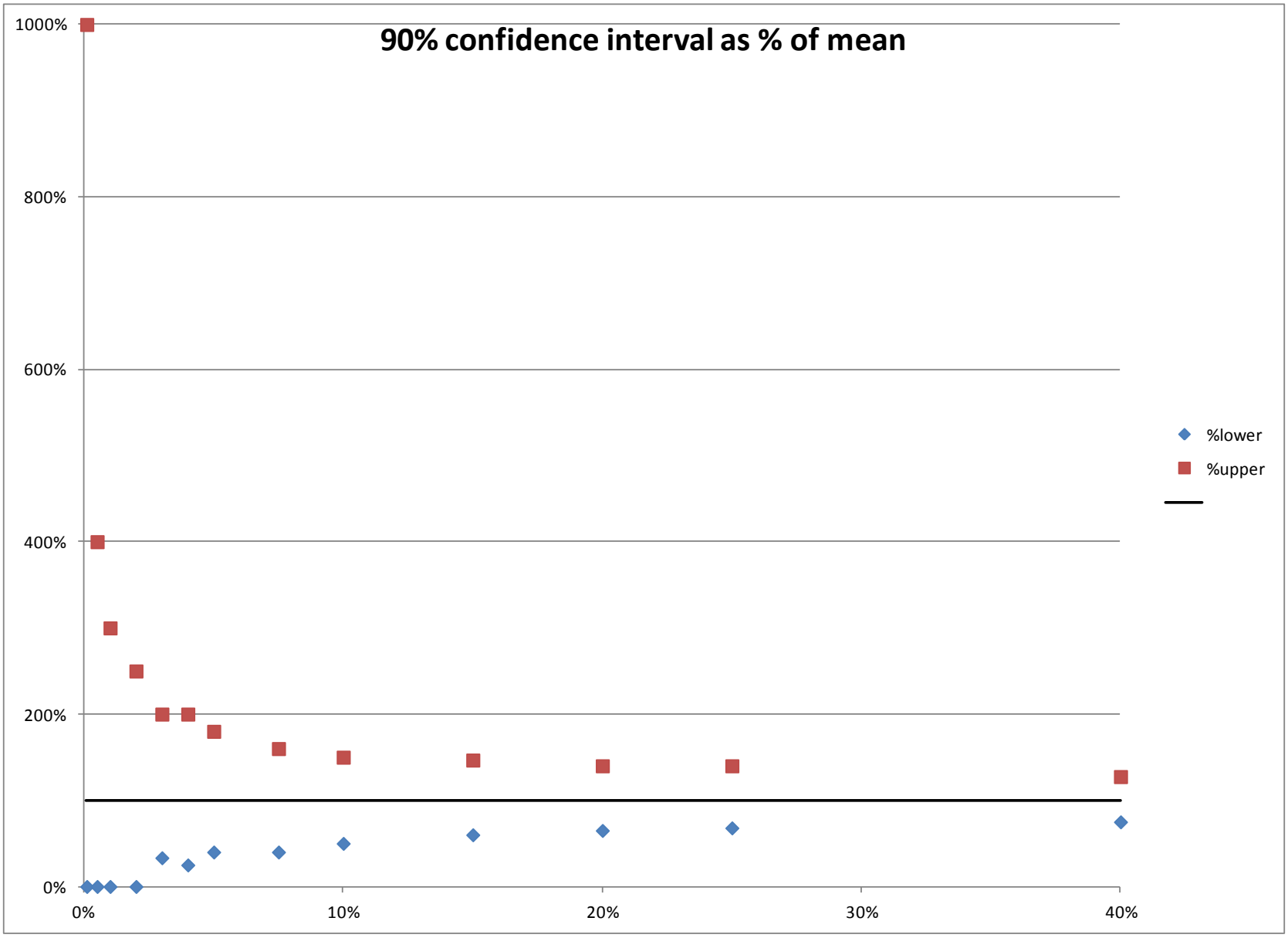
90% confidence interval loss cost : 5% to 15%

Bootstrapping, assuming Poisson frequency, total loss severity, and 100-year sample

Confidence intervals



Confidence intervals



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- Factors potentially influencing relative confidence interval widths
  - Larger data sample / destabilizing recent experience
  - Improvements in science / weakening of stationary climate assumption
  - Improvements in technology
  - Differences in modeled portfolios
  - Frequency distribution
  - Increased awareness of factors contributing to uncertainty

Limitations of Cat Models

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- Relative widths of individual company confidence intervals will depend on specifics
  - Geographical scope
    - e.g., US hurricane, Peru earthquake, UK flood
  - Insured portfolio
    - e.g., Dwellings, Petrochemical facilities, Hotels
  - Financial variables
    - e.g., Excess policies, EQ sublimits, Business interruption
  - Data quality